Prevention Of Dental Caries

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Learning Objectives

By the end of this lecture, the students should be able to:

1. Understand the four levels of prevention.
2. Analyze the three core factors of dental caries (host, agent, and environment).
3. Evaluate methods for combating microorganisms.
4. Identify methods to increase tooth resistance.
5. Plan to prevent dental caries at both the individual and community levels.

Prevention Of Dental Caries

Levels of preventive care

1. Primary-primary prevention (Primordial Prevention)
2. Primary prevention
3. Secondary prevention
4. Tertiary prevention

1-Primary- Primary Prevention (Primordial Prevention)

- Prevents the development of risk factors before they appear.
- Focuses on promoting healthy lifestyles and environmental changes.
- **The services of primordial prevention are**

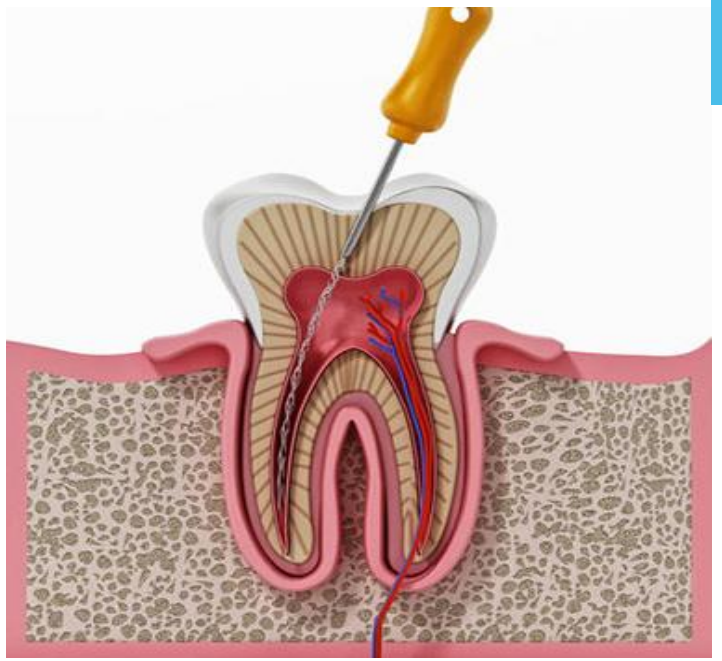
1. Oral health education of expectant mothers to keep their mouths in good oral hygiene.
2. Restoration of all cavitated lesions in the mother's oral cavity to reduce the reservoir and transmission of cariogenic microorganisms, particularly *S. mutans & LB*.

2- Primary Prevention

Preventing and reversing the progression of disease before treatment becomes necessary. It is carried out on healthy populations

➢ **The services of primary prevention are:**

1. Oral evaluation, early detection of oral diseases
2. Plaque control (chemical and mechanical)
3. Fluoride and fissure sealants
4. Health education



3- Secondary Prevention

Aims to terminate the disease process and restore the affected tissues as close to normal as possible.

➢ **The services of secondary prevention are:**

1. Dental Restorations

2. Endodontic treatment

4- Tertiary Prevention

•Reduces complications and restores function after the disease has progressed.

•Focuses on rehabilitation and limiting disability.

➢**The services of tertiary prevention are:**

1. Prosthetic appliances (crowns, dentures)
2. Implants

❖Priority is given first to the primary preventive services, followed by 2ndry then tertiary preventive services

❖**Preventive services activity implemented by**

1) The individual: tooth brushing, mouth rinse
2) The community: school & community water fluoridation
3) Dental professional: fluoride, fissure sealants application

In 1^{ry} prevention, individual, community, and professional efforts are available. While in the 2nd and 3rd prevention, the professionals play the greatest role.

Prevention Of Dental Caries

To control and fight dental diseases, greater attention must be given to etiologic factors, which are divided into 3 categories:

I. **Host** factor: Tooth

II. **Agent** factors: Bacterial microflora, which include S. mutans and LB.

III. **Environnemental** factor: Diet

The previous 3 factors are mediated by time

A Strategy For Prevention Of Dental Caries

I. Caries risk assessment

II. Early caries detection

III. Combating the microorganism

IV. Enhancing Tooth Resistance and Remineralization

V. Control and modification of diet

I. Caries Risk Assessment

Patients can be classified according to risk of developing dental caries into:

1. **Low risk of dental caries**
2. **Moderate risk of dental caries**
3. **High risk of dental caries**

Dentists need to identify patients at high risk of dental caries, as the priority in preventive treatment is given to the high-risk group

Caries Risk Assessment Tools:

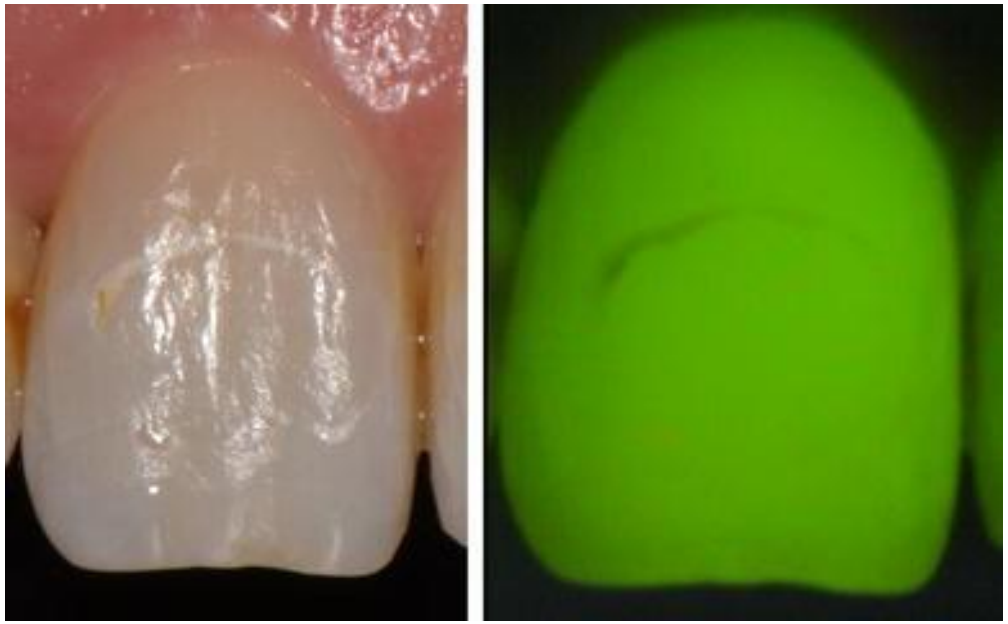
1. Past caries experience (decayed, missed, and filled teeth)
2. Bacterial count
3. Oral hygiene
4. Dietary habits
5. Salivary parameters
6. Fluorides
7. Others modifying factors(age, gender, medical factors, socio-economic factors)

II. Early Caries Detection

Detection of dental caries in the early stage facilitates arresting and reversing the process of demineralization. Early caries lesions (enamel caries) can be arrested by remineralization, while caries in dentin needs restorative treatment.

Methods of dental caries detection:

1. Visual and tactile method with mirrors and probes
2. X-ray radiographs and digital radiographs
3. Fiber optic trans illumination
4. Quantitative light fluorescence
5. Electrical conductivity
6. DiagnoDent



Quantitative light fluorescence

III. Combating The Micro-organisms

- ***This occurs through daily plaque control of the teeth and adjacent oral tissue through:***

1. Mechanical removal of plaque
2. Chemical removal of plaque
3. New strategies (vaccine, probiotics, and replacement therapy)

A. Mechanical Removal of Dental Plaque

Mechanical plaque control is the physical removal of dental biofilm from tooth surfaces.

It is the most effective and basic method for preventing dental caries and periodontal disease.

Methods

1. Tooth brushing twice daily with fluoride toothpaste
2. Dental floss for interdental cleaning
3. Tongue cleaners for tongue cleaning
4. Professional dental cleaning when needed

Importance

I. Prevents plaque accumulation and demineralization

II. Improves oral hygiene and gingival health

III. Enhances the effectiveness of fluoride and other preventive measures

B. Chemical Control of Dental Plaque

Chemical plaque control involves the use of antimicrobial agents to reduce dental biofilm and cariogenic microorganisms. It is usually used as an adjunct to mechanical plaque removal, not as a replacement.

Common Chemical Agents

a. Chlorhexidine (CHX) mouthwash or varnish

b. Essential oil mouthwashes (such as Listerine)

c. Cetylpyridinium chloride (CPC) mouthwash

d. Triclosan-containing toothpaste

Benefits

- Reduces bacterial count and plaque formation
- Enhances overall oral hygiene maintenance

C. Caries Vaccines (Immunization)

A vaccine is an immunobiological substance designed to produce specific protection against disease.

Types of immunizations

A. Active immunization (Ab to Ag) :

By using Streptococcus mutans cells, the cell wall or synthetic *S.* mutans peptides

The action

- Enhance immune response by generating protective antibodies in both the gingival fluid and saliva.

B. Passive immunization (direct Ab)

- Passive immunization by the oral application of preformed antibodies against selected antigens of mutans streptococci.
- It is safer than active immunization and depends on the direct introduction of specific pre-targeted antibodies into the mouth.

Source of Antibodies: Antibodies against Streptococcus mutans can be obtained from cow's serum, milk, or the yolk of eggs.

D. Probiotics

Probiotics are live micro-organisms that are safe for human consumption and when ingested in sufficient quantities have a beneficial effect on human health. E.g. Lactobacillus acidophilus and Bifidobacterium bifidum.

Mechanism:

- In the oral cavity, probiotics can create a biofilm acting as a protective lining for oral tissues against oral diseases. Such a biofilm can compete with cariogenic bacteria and periodontal pathogens' growth.
- It can be added to milk, cheese, or yogurt.
- Cheese might be the ideal vehicle for administering probiotics to humans. Cheese enhances remineralization and prevents demineralization of enamel.
- Regular consumption of probiotic products is needed to maintain the preventive and therapeutic levels.

E. Replacement Therapy

Replacement therapy is a preventive approach in which cariogenic bacteria, particularly Streptococcus mutans, are replaced by less cariogenic or non-cariogenic bacterial strains.

Methods:

1) Genetic modification of Streptococcus mutans to reduce or eliminate acid production.
2) Development of genetically altered S. mutans strains capable of producing alkali (e.g., ammonia) instead of large amounts of organic acids.
3) Introduction of non-cariogenic or less cariogenic bacterial strains that compete with and suppress cariogenic microorganisms within the dental biofilm.

IV. Increasing Tooth Resistance & Remineralization Therapy

Through

1) Fluoride application
2) Pit and fissure sealant
3) Minimal invasive dentistry (MID)
4) Ozone
5) Laser

A. Fluoride Application

Methods of fluoride application

1. Systemic Fluoride (Pre-eruptive)

Fluoride is incorporated into developing teeth during formation.

❖**Examples of systemically applied fluoride routes:**

a. Community water fluoridation
b. Fluoridated salt
c. Fluoridated milk
d. Dietary fluoride supplements (tablets, drops)

Action:

Incorporated into enamel and dentin during development:

a. Produces smoother enamel with reduced porosity.
b. Enhances mineral content of enamel and dentin, increasing resistance to caries formation.

2. Topical Fluoride (Post-eruptive)

Fluoride acts directly on erupted tooth surfaces.

1. Toothpaste (daily home use)
2. Mouth rinses (daily/weekly)
3. Fluoride varnish (professional use)
4. Gels and foams (professional application)
5. Fluoride incorporated in dental restorations (e.g., glass-ionomer)

Action:

a. Enhances remineralization
b. Inhibits demineralization
c. Reduces bacterial acid production

B. Pit and fissure sealant

A preventive resin material is applied to the occlusal pits and fissures of the teeth to create a *physical barrier* against bacteria and food accumulation.

Mechanism of action:

- Seals deep grooves → prevents food and bacteria retention

Indications:

- High caries risk patients
- Newly erupted permanent molars and premolars with deep pits and fissures

Types:

- Resin-based sealants (most common)
- Glass ionomer-based sealants (temporary sealant)

Advantages:

- Highly effective in caries prevention
- Painless and non-invasive
- Quick application

C. Minimal Invasive Dentistry (MID)

A modern preventive and treatment approach that aims to preserve as much natural tooth structure as possible while managing dental disease.

The principles:

1. Early detection of dental caries
2. Risk assessment and disease control
3. Prevention before restoration
4. Conservative removal of only infected tissue
5. Preservation of healthy tooth structure

D. Ozone And Caries Prevention

Ozone consists of three oxygen atoms (O_3) and acts as a powerful oxidizing agent.

It has a bactericidal effect and may enhance remineralization through the following mechanisms:

1. Creating a more alkaline environment within the carious lesion, which promotes mineral uptake and remineralization.
2. Reducing the number of cariogenic microorganisms and their acid production.

E. Laser

Laser irradiation can modify the enamel surface and increase its resistance to acid dissolution by reducing enamel permeability and producing surface changes that resemble a ceramic-like structure.

Advantages

1. Increases enamel resistance to dental caries
2. May inhibit or slow the progression of early carious lesions
3. Can be combined with fluoride therapy to enhance fluoride uptake and remineralization

Disadvantages

i. High cost and need for specialized equipment and training

ii. Risk of thermal damage to pulp or soft tissues if improperly used

V. Control and Modification of Diet

Diet modification is the restriction of sugars and encouragement of using sugar substitute sweeteners that do not promote dental caries.

❖**Control diet by:**

1. Controlling the fermentable carbohydrate
2. Good general nutrition, as proper nutrition, is essential for the proper development and maturation of teeth
3. Taking protective food

Examples of Protective Elements in Diet

1. **Fluorides**: (its mechanism of action mentioned before)

2. **Phosphates:**

i. It prevents phosphorus loss from tooth enamel.

ii. Phosphates, along with calcium and fluoride ions, contribute to the remineralization of incipient demineralized areas of enamel.

iii. The phosphates improve the structure of the enamel surface by making it harder and smoother.

iv. Phosphates can also inhibit bacterial growth

3. Fats

Fats seem to reduce the cariogenicity of different foods through:

i. Fat forms a protective barrier on the tooth surface.

ii. It may surround the carbohydrates, making them less available and making their removal from the oral cavity a little faster.

iii. Some fatty acids exhibit antimicrobial activity, which could affect plaque formation.

4. Cheese

Action of cheese:

i. Reduces the levels of cariogenic bacteria in the oral cavity.

ii. Its high calcium and phosphorus content promotes remineralization and contributes to its cariostatic effect.

iii. Casein and other cheese proteins have protective cariostatic properties.

Caries Prevention Can Be Done at two levels:

A. Individual Level

B. Community Level

A. Caries Prevention at the Individual Level

1. Individual oral health instructions

2. Mechanical & chemical plaque control

a. Proper tooth brushing with fluoridated toothpaste

b. Chlorhexidine mouthwash, varnish, or gel to reduce cariogenic bacteria

3. Dietary control

a. Reduction of fermentable carbohydrates (especially sucrose)

b. Use of sugar substitutes such as **xylitol** and **sorbitol** to reduce caries risk

4. Fluoride therapy

5. Pit and fissure sealants

✓ Applied to newly erupted permanent molars

B. Caries Prevention at the Community Level

1. Community-based oral health education programs

2. Community-based fluoride & sealants application programs

a. Community and school water fluoridation

b. Providing fluoridated toothpaste for infants and children

c. Topical fluoride (varnish, gel..) applications for infants, children, and older adults

d. Applying pit and fissure sealants for school children (e.g., 2nd and 6th grade)

3. Early screening and caries risk assessment programs

a. Screening 1-year-old children to identify high-risk cases

b. Regular follow-up with preventive care plans

4. Maternal and child oral health programs

✓ Screening high-risk pregnant women and providing dental treatment

5. Access to care and equity

✓ Providing dental care services for low-income families or the underserved areas

Summary Of Basic Recommendations Of Caries Prevention In Permanent Teeth (2026)

Preventive Measure	Recommendations
1. Mechanical Plaque Control	Brush teeth twice daily with fluoride toothpaste. Clean between teeth using dental floss or interdental brushes.
2. Chemical Plaque Control	Use antimicrobial agents such as chlorhexidine (CHX) varnish, especially during orthodontic treatment or for exposed root surfaces.
3. Prevention Programs	Participate in regular preventive dental programs, particularly for patients with high caries risk.
4. Fluoride Measures	Use fluoride toothpaste daily. Additional fluoride products (varnishes, gels, rinses) may be recommended for high-risk patients.
5. Dietary Control	Reduce sugar intake and frequency of sugary snacks/drinks. Prefer foods and drinks without added sugar.
6. Saliva Stimulation	Chew sugar-free gum, especially after meals, to stimulate saliva flow and reduce caries risk.
7. Fissure Sealants	Apply sealants to deep pits and fissures that are susceptible to dental caries.

REFERENCES

A Textbook of Public Health Dentistry, CM Marya, **Jaypee Brothers Medical Publishers, 1st ED;** 2011.

THANK YOU